

PATENT SPECIFICATION



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COMPLETE SPECIFICATION.

Improvements in Liners for Tube and like Mills.

A communication from abroad from F. L. SMITH & Co., A/S, a company organised under the laws of Denmark, of 33, Vestergade, Copenhagen, Denmark.

I, HUBERT ALEXANDER GILL, M.A., Cantab., Chartered Patent Agent, a British subject, of 51/52, Chancery Lane, London, W.C. 2, England, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

10 Liners of silix, either of shaped blocks of the natural stone or of irregular pieces grouted in, were formerly employed almost exclusively for lining the shells or drums of tube mills and ball mills and were generally satisfactory, except for variations in hardness, which necessitated renewal of portions of the lining. The difficulty in shaping the blocks of natural stone and variations in the composite linings, together with the increasing difficulty in securing silix of uniform quality, the scarcity of the supply and the increasing cost have led to many efforts to produce substitutes for the

25 silix liners, cast metal liners being commonly provided and so formed as to prevent the charge of grinding bodies and of the material operated upon from slipping on the inner surface of the liners, and, therefore, failing of that degree of constant agitation which is necessary to secure the maximum of efficiency in a given mill. Most of such cast metal liners, as heretofore produced, quickly become smooth and permit the undesirable slipping of the charge, or are otherwise subject to such wear that they quickly become broken, with the results that they must be replaced frequently and that there is excessive waste in the form of scrap. Suggestions have been made previously to construct a mill lining of cement or concrete, in the form of blocks or segments in which are embedded

45 a series of pins, posts, pegs or bars, pre-

[Price 1/-]

ferably of steel, of rounded or other shape or configuration so arranged that they may be removed and replaced when they have been worn down.

The object of this invention is, therefore, to provide a liner which shall be capable of long continued use without becoming smooth and without requiring replacement at such a stage of wear as to involve excessive waste in scrap. In accordance with the invention the improved liner is made up of longitudinal bars of metal which, for convenience in manufacture and in application, may be bridged in series so as to form liner blocks of a size convenient for handling and application, the metal bars being separated (except for such bridges) by spaces which are filled with grout, by which also the bars or blocks are secured in place within the shell or drum. To secure the most satisfactory result, the relative width of the grout filled spaces to the width of the bars is determined to some extent by the size and character of the grinding bodies with which the mill is charged, the width of the grout filled spaces being such as to permit the cement grouting, when set, to be worn away by the conjoint action of the grinding bodies and the material being ground at about the rate of wear as that to which the deeper and harder metal bars are worn away, so that the longitudinally corrugated inner working surface of the liner is maintained throughout its use until the cement filling is almost completely worn away and of the metal bars but little is left to become scrapped. The corrugated working surface is provided at the outset by providing metal bars of greater depth than the grouting and by sinking the grouting somewhat below the working surface of the bars. Preferably, also, the bars are formed at the outset with somewhat rounded working surfaces, this characteristic being maintained throughout the wearing of the liner so that agitation of the charge is kept up continuously in the operation

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of the mill and there is practically no slipping of the charge on the liner. The invention will be more fully explained hereinafter with reference to the accompanying drawings in which it is illustrated, and in which:

Figure 1 is a face view of a series of bars cast in one block.

Figure 2 is a longitudinal section on the plane indicated by the broken line 2—2 of Figure 1.

Figure 3 is a transverse section on the plane indicated by the broken line 3—3 of Figure 1.

Figure 4 is a view in transverse section, on a larger scale, illustrating the manner of coaction of cylindrical grinding bodies with the improved liner.

Longitudinal bars *a, a*, of a length convenient for handling and preferably having a rounded working surface *a¹* and a recessed rear surface *a²*, are united by casting in a block for convenience in handling and in application to the shell of the mill, with a suitable curvature of the block, so as to leave between successive bars longitudinal spaces *b, b*, which penetrate the block from face to back. The bars are united at intervals by bridges *c* which, as shown in Figure 2, preferably do not extend to the rear face or back of the block, but leave, in the rear portion of the block, channels which extend continuously from end to end. Each outer bar of the block is preferably formed, at its outer side, with spacing projections *h* so as to provide spaces between the adjacent bars of adjacent blocks.

When the blocks have been placed within the shell *d* of the mill, cement grout *f* is forced into all of the spaces *b* between the bars and between the blocks and into the recesses *c²* in the blocks of the bars, so that when the cement has set the blocks are securely held in place. In fitting the blocks to the mill one or more bars *a* may be split off as may be desired and wedges may be driven in between adjacent blocks to secure the same if necessary.

Preferably, the bars themselves and the spaces between them are of such widths as may be determined by the size and character of the grinding bodies employed. As shown in Figure 4, the short cylindrical grinding bodies *g* are preferably employed and in that case and as also with grinding bodies of different shape, the bars have a width somewhat in excess of the greatest dimension of the grinding bodies and the spaces between the bars have a width somewhat less than the minimum dimensions of the grinding bodies. The purpose of such

relation of dimensions is that in the operation of the mill, the relatively softer cement grout shall be worn away by the conjoint action of the grinding bodies and the material being ground at about the same rate as the metal bars *a* are worn away, whereby the longitudinally corrugated working face of the liner is maintained until the cement grout is practically worn away and the bars are worn to such a thinness that they become liable to breakage.

In the foregoing description it has been assumed that the bars *a, a* are of cast metal and the filling in the spaces between such bars of cement grout, but it will be obvious that such invention may be realized with other materials, the bars being of any suitable hard material and the filling between the bars of relatively softer material, whereby the corrugated working surface will be maintained as the liner wears.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A liner for tube and like mills, having longitudinal bars of hard metal or other hard material spaced apart and a filling of relatively softer material between the bars

2. A liner for tube and like mills, having longitudinal bars of metal or other hard material spaced apart and a filling of cement grout between the bars.

3. A liner for tube and like mills, comprising blocks of longitudinal bars of metal or other hard material with intervening spaces and connecting bridge pieces, and a filling between the bars of relatively softer material.

4. A liner for tube and like mills, comprising blocks of longitudinal bars of metal or other hard material with intervening spaces and connecting bridge pieces, and a filling of cement grout between the bars.

5. In a tube or like mill, the combination of a shell and a liner composed of longitudinal bars of metal or other hard material spaced apart and connected by bridge pieces, and a filling of cement grout between and back of the bars.

6. Liners for tube and like mills, constructed and arranged substantially as described in connection with the accompanying drawings.

Dated this 6th day of July, 1926.

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FIG. 1.

FIG. 2.

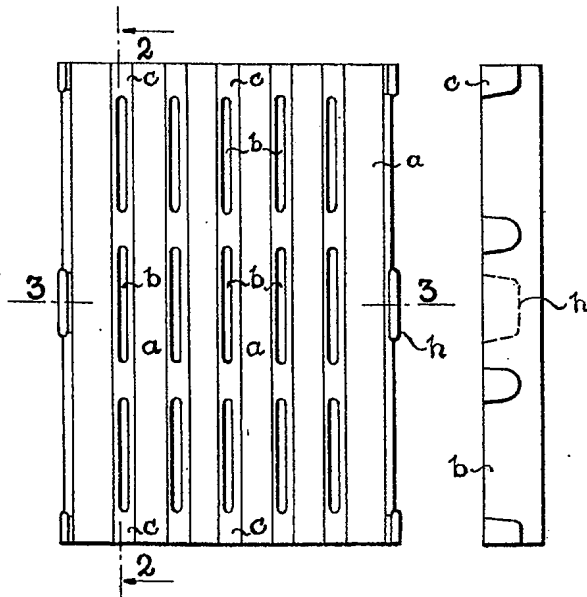


FIG. 3.

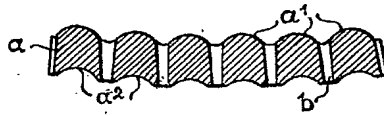


FIG. 4.

